

Claims

1. A projection electron microscope which causes an illuminating electron beam emitted from an electron source to be incident on a sample surface via an illumination electron optical system, and which causes electrons emitted from this sample surface to be focused as an observation electron beam on a detection means via an image focusing electron optical system, wherein this projection electron microscope has an optical path switching means which switches the direction of the illuminating electron beam or observation electron beam, and the optical path switching means has the function of switching the direction of the respective electron beams so that the illuminating electron beam is incident on the sample surface at a specified timing, and so that the observation electron beam reaches the detection means at a different specified timing.

2. The projection electron microscope according to Claim 1, wherein the observation electron beam consists of reflected electrons having an energy equal to that of the illuminating electron beam, the illumination electron optical system consists of an illumination dedicated electron optical system disposed between the electron source and the optical path switching means, and an electron optical system disposed between the optical path switching means and the sample surface, the image focusing electron optical system consists of an image focusing dedicated electron optical system disposed between the detection means and the optical path

switching means, and the electron optical system mentioned above, and the electron optical system shares some of the functions of the illumination electron optical system and the image focusing electron optical system.

3. The projection electron microscope according to Claim 2, wherein the observation electron beam consists of reflected electrons having an energy equal to that of the illuminating electron beam, and the illumination electron optical system and the image focusing electron optical system consist only of an electron optical system disposed between the optical path switching means and the sample surface.

4. The projection electron microscope according to Claim 1, wherein the optical path switching means has the function of conducting the illuminating electron beam to the sample surface in a time that is equal to or less than the time required for the electrons in the illuminating electron beam to reach the sample surface from the optical path switching means.

5. The projection electron microscope according to Claim 1, wherein the optical path switching means has the function of conducting the illuminating electron beam to the sample surface in a time that is equal to or less than the time required for the electrons in the illuminating electron beam to complete a round trip between the most constricted point of the electron beam in the electron optical system and the sample.

6. A projection electron microscope which causes an illuminating electron beam emitted from an electron source to be incident on a sample surface via an illumination electron optical system, and which causes electrons emitted from this sample surface to be focused as an observation electron beam on a detection means via an image focusing electron optical system, wherein the observation electron beam consists of reflected electrons having an energy equal to that of the illuminating electron beam, the illumination electron optical system consists of an illumination dedicated electron optical system disposed between the electron source and the above mentioned optical path switching means, and an electron optical system disposed between the optical path switching means and the sample surface, the image focusing electron optical system consists of an image focusing dedicated electron optical system disposed between the detection means and the optical path switching means, and the electron optical system described above, and this electron optical system shares some of the functions of the illumination electron optical system and the image focusing electron optical system.

7. A micro-device manufacturing method having a step in which the surface of a micro-device or intermediate product of the same is inspected using the projection electron microscope of any one of Claims 1 through 6.

8. An electron microscope comprising an electron source which causes an illuminating electron beam to be incident on a sample surface, a detector which detects electrons emitted from the sample surface as an observation electron beam, and an optical path switching means which causes the illuminating electron beam to be incident on the sample surface at a specified timing, and which causes the observation electron beam to reach the detector at a different specified timing.

9. The electron microscope according to Claim 8, wherein the optical path switching means has the function of switching between the specified timing described above and the other specified timing described above according to whether or not a voltage is applied to this optical path switching means.

10. A sample surface observation method for observing a sample surface, wherein an illuminating electron beam is emitted, this illuminating electron beam is caused to be incident on the sample surface at a specified timing, observation electrons emitted from the sample surface are caused to reach a detector at a timing that is different from the specified timing described above, and the observation electrons are detected by the detector, so that an image of the sample surface is acquired.